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SENSITIVE PLANT SURVEYS IN THE
GALLATIN NATIONAL FOREST, MONTANA

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EXECUTIVE SUMMARY

Four areas of the Gallatin National Forest, including the Bridger and Crazy Mountains, Hyalite Canyon, and the upper Gallatin Valley, were surveyed for sensitive species recognized by Region 1 of the U.S. Forest Service, and for prospective sensitive species currently tracked as Montana plant species of special concern. A historical occurrence of Oregon checker-mallow (*Sidalcea oregana*) was relocated in Hyalite Canyon, and is recommended for addition to the U.S. Forest Service sensitive species list. New populations were found of fan-leaved daisy (*Erigeron flabellifolius*) and Suksdorf monkeyflower (*Mimulus suksdorfii*) but are not recommended for sensitive status. A new population of Wolf's willow (*Salix wolfii* var. *wolfii*) was also found; it is currently recognized as sensitive on the U.S. Forest Service sensitive species list, but this status may warrant re-examination pending annotation of all *Salix wolfii* specimens in Montana to variety.

Herbarium work revealed that historical reports of four other species on the Gallatin National Forest are probably based on misidentifications or taxonomic discrepancies. They include:

boreal wormwood	<i>Artemisia norvegica</i>
Coville's rush	<i>Juncus covillei</i>
diverse-leaved cinquefoil	<i>Potentilla diversifolia</i> var. <i>multisecta</i>
Cascade willow	<i>Salix cascadiensis</i>

In addition, Gallatin National Forest Herbarium specimens were organized and reviewed for sensitive species collections. Two records were found, one for Wind River draba (*Draba ventosa*) and another for Wolf's willow (*Salix wolfii* var. *wolfii*). The site of the Wolf's willow was relocated in the course of this survey project. The site of the Wind River draba was not known until further literature search revealed that it was apparently collected from what is now within Beaverhead National Forest rather than Gallatin National Forest.

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INTRODUCTION

This report describes botanical surveys of select areas on the Gallatin National Forest for sensitive plant species and prospective sensitive plant species with pressing status questions. A high priority was given to relocation of target species which were known historically from the Forest but which had not been collected or surveyed in recent years, particularly those potentially affected by land use activities. Surveys to determine the location and size of rare plant populations represent initial steps in identifying conservation priorities and developing protection strategies; previous baseline surveys on the Gallatin National Forest include studies by Mathews (1989) and Nixon (1993). Secondary goals were to inventory the general flora, and to organize the Gallatin National Forest Herbarium and search it for records of sensitive species. Fieldwork was centered in four areas of the Forest: the Bridger Mountains, the Crazy Mountains, Hyalite Canyon, and the upper Gallatin valley.

Sensitive and watch species targets were identified using the Sensitive Plant Field Guide (USDA Forest Service 1988, with amendments as listed in Lesica and Shelly 1991). Prospective sensitive species were considered among the Montana plant species of special concern list (Heidel and Poole 1993), taken to include all vascular plant taxa which are "rare, endemic, disjunct, threatened, or endangered throughout their range or in Montana, vulnerable to extirpation from Montana, or in need of further research". Sensitive and watch species, and Montana plant species of special concern, will collectively be referred to as "target species" in this report.

THE STUDY AREAS

1. Bridger Mountains

This isolated range in the northern part of the Gallatin National Forest, was formed by steep folding trending slightly west of north (Alt and Hyndman 1986). The range is capped by Mesozoic sedimentary rocks, which lie on top of Paleozoic and Precambrian formations. Madison limestone is exposed extensively in the range. The spectacular cirque above Fairy Lake is evidence of glaciation in the range. The mountains rise from about 5,000 ft. at their western base in the Gallatin Valley to just over 9,600 ft. on Sacagawea Peak.

Vegetation types in the Bridgers which were surveyed included riparian woodlands and thickets, sagebrush grasslands, montane to alpine meadows, coniferous forests, and rock outcrops. Habitat on the west side of the range is somewhat warmer and dryer and the slopes are mostly

unforested; the patchy coniferous forests are dominated by Douglas fir. On the east side at upper elevations, Engelmann spruce and subalpine fir forests are common. The tree line in the Bridgers is generally around 9,000 ft. and is somewhat lower on the east side of the crest. The highest elevations in the range support an alpine flora. Limestone loving plants (e.g. *Petrophyton caespitosum* and *Telesonix jamesii*) constitute another conspicuous element. Due to its close proximity to Montana State University in Bozeman, the Bridgers are relatively well botanized, with many specimens from the range deposited at the University's herbarium (MONT).

2. Crazy Mountains

This is another isolated range, also in the northern part of the GNF. Land ownership in the Crazies, unlike the continuous Gallatin National Forest tracts of the Bridgers, is a checkerboard pattern of National Forest and private sections. The northern part of the range, which was not surveyed, lies on the Lewis and Clark National Forest.

The Crazy Mountains are geologically unique in Montana, composed of resistant igneous intrusions and "hard baked sedimentary rocks" (Alt and Hyndman 1986). The igneous rocks in the northern part of the range are rich in sodium and potassium, but alkali metals are less abundant in the large Big Timber Stock in the southern part of the range where this survey was centered. The Crazies, like the Bridgers, were shaped by isolated mountain glaciers during the Pleistocene, and some small glaciers persist today. The Crazies are higher than the Bridgers, rising to over 11,000 ft. on Crazy Peak.

Habitat types which were surveyed included coniferous forests, montane to alpine meadows, seep areas, and most common of all, sparsely-vegetated rock faces, slides, and boulder fields. The most highly developed alpine flora was seen in the basin of Sunlight Lake, where patches of tundra occur within the otherwise continuous rocky landscape. In contrast to the pristine alpine habitat around Sunlight Lake, the rest of the Sweet Grass Creek drainage, from the montane zone near Eagle Park to the alpine around Glacier Lake, is heavily impacted by cattle grazing. In addition, lakeshore habitat in some easily accessed basins in the Big Timber Creek drainage (e.g. Granite/Blue Lakes and Twin Lakes) has been degraded by heavy recreational use. The Crazies have not been well botanized in the past, however Klaus Lackschewitz has done some collecting in the range.

3. Hyalite Canyon

This canyon is in the northern part of the Gallatin Mountains, just south of Bozeman. The Gallatins are a volcanic range; the Hyalite volcanics consist of andesite and breccia (Chadwick 1982). The Hyalite drainage is mostly

forested, with lodgepole pine and Engelmann spruce being the dominant species. The lower canyon is narrow with steep, rocky sides, but the valley widens further upstream, with broader floodplains, and some creekside meadows. The elevations of the surveyed areas are between 6,500 and 7,000 feet. Like the Bridgers, Hyalite Canyon has been relatively well botanized.

4. Upper Gallatin Valley

The areas which were surveyed are directly adjacent to the Gallatin River and its tributary, Taylor Fork, just north of the Yellowstone National Park boundary. Geologically, these valleybottom areas are mostly alluvial formations (floodplains and terraces), but limestone talus on the adjacent canyon walls was also explored. Elevations are between 6,500 and 7,000 feet. The floodplain vegetation is dominated by willows and birch, and vegetation on the terraces is sagebrush grasslands with scattered lodgepole pines. This area has been well botanized in recent years.

METHODS

Prior to fieldwork, the Biological Conservation Database of the Montana Natural Heritage Program was queried for all occurrences of sensitive or prospective sensitive species on the Gallatin National Forest, producing 44 element occurrence records (EORs) of 31 plant taxa. These target taxa are listed in Table 1. Fieldwork focused on those species which were known historically from the Forest but had not been surveyed or collected in it for over 40 years.

Selection of study areas was based on historic record locations of the target species, in consultation with the Gallatin National Forest.

Field surveys were conducted from July 9 to 21 and August 10 to 19, 1993. On July 10, the southern end of the Forest was visited in the upper Gallatin valley to get target species search images at known populations of *Castilleja gracillima* and *Salix wolfii* var. *wolfii* in the vicinity of Snowflake Spring in the upper Gallatin Valley. In addition, potential habitat for these plants was surveyed along Taylor Creek.

The remainder of the time was spent in the northern part of the Forest, surveying Hyalite Canyon and the Bridger and Crazy Mountains. The focus of the Hyalite survey was an attempt to relocate *Sidalcea oregana*, last collected from the area in 1957. The search was at first concentrated in the lower valley, but on the last day was extended to the area above Hyalite Reservoir.

The work in the Bridger and Crazy Mountains was broader in scope, but included similar efforts to relocate historical occurrences of target species. The two historical species of concern in the Bridgers were *Artemisia norvegica* var. *saxatilis*, represented by a 1958 collection from Fairy Creek, and *Potentilla diversifolia* var. *multisecta*, also known from the Crazies, based on collections taken around the turn of the century. Searches were conducted in the Crazy Mountains for *Salix cascadiensis*, known by a 1945 collection from near Granite Lake, and for two target species known from more recent collections, *Erigeron flabellifolius* (from 2 locations: above Sunlight Lake and above Trespass Creek) and *Juncus covillei* (from Big Timber Canyon). No attempt was made to relocate populations of *Agoseris lackschewitzii*, which was recently surveyed in the Crazies. No other target species are known to occur on the Gallatin National Forest in these two ranges.

I searched for these species at their known locations as well as in suitable habitat elsewhere in the ranges. Searches were made on foot usually on day hikes, but a three-day backpack trip was taken in the Crazy Mountains. Maps showing survey routes are included as Appendix A in this report.

When populations of target species were found, they were surveyed and sensitive plant survey forms were filled out. Population numbers were estimated and their precise location and boundaries were mapped. Data gathered on habitat included dominant and associated vegetation and edaphic attributes of the site. Specimens of the plants were collected, and often, photographs of the site and close-ups of the plants were taken.

In conjunction with the species specific searches, general floristic inventories were conducted. A broad range of habitats were surveyed on the way to and from the historical target species sites. In some areas of exceptional habitat, preliminary surveys were conducted in the absence of known element occurrences. In all areas visited, daily species lists were made, including all vascular plant taxa which were recognized or could be keyed out. These lists were necessarily incomplete, because locations were generally visited only once during the season. From these daily lists a master list of species identified on the GNF was constructed (Appendix B). The field guides used most often to key out plants were Dorn (1984) and Hitchcock and Cronquist (1973).

Collections were made of all target species and of many other taxa, especially those which were difficult to identify in the field or which seemed to be outside their known range. Specimens were pressed and dried in the usual manner, and identified in the herbarium in the fall. Determinations of



certain groups were made by specialists; these included all Apiaceae and Caryophyllaceae (Ronald Hartman, Rocky Mountain Herbarium, University of Wyoming, Laramie), all Salicaceae (Robert Dorn, Rocky Mountain Herbarium), all Poaceae (Michael Curto, Intermountain Herbarium, Utah State University, Logan), and Castilleja (Sarah Mathews, Montana State University, Bozeman). All specimens of *Potentilla* were sent to Barbara Ertter (University Herbarium, U. of California, Berkeley). The first set of collections will be deposited at the herbarium at Montana State University (MONT).

The project got a late start so herbarium work was conducted at MONT during the field season. Historical collections of *Potentilla diversifolia* and *Sidalcea oregana* were examined to gain insight into taxonomic questions and locations, respectively. I also organized the limited collection of plants kept by the Gallatin National Forest Herbarium and searched it for records of target species. This collection is kept in a single cabinet located in Marion Cherry's office at the Gallatin National Forest Office in Bozeman.

In the fall, the historical collections of *Artemisia norvegica* and *Salix cascadiensis* were borrowed from the University of Washington so that their identities could be verified. In a similar manner, Peter Lesica obligingly checked the specimen of *Juncus covillei* from the Crazy Mountains at the University of Montana herbarium (MONTU).

Table 1. Montana Plant Species of Special Concern known on the Gallatin National Forest. Further information is given in this report for those taxa which are in bold type.

<u>Scientific name</u>	<u>USFS status</u>	<u>Heritage rank¹</u>	
Agoseris lackschewitzii	sensitive	G3	S2S3
Allium simillimum	-	G4	S1
Aquilegia brevistyla	sensitive	G5	S1
Artemisia norvegica	-	G5T?	S1
Balsamorhiza macrophylla	sensitive	G3G5	S1
Carex multcostata	watch	G5	S1
Carex neurophora	-	G4	S1
Carex tinctoria	-	G4G5	S1
Castilleja gracillima	sensitive	G3G4	S1
Draba globosa	-	G?	S1
Draba ventosa	-	G2G3	S1
Drosera anglica	-	G5	S2
Epilobium suffruticosum	-	G5	S2
Erigeron eatonii ssp. eatonii	watch	G5T5	S1
Erigeron flabellifolius	-	G3G4	S3
Erigeron formosissimus var. viscidus	-	G4T4	S1
Erigeron gracilis	-	G4	S2
Gentianella tenella	-	G5	S1
Juncus covillei	-	G4G5T4	SU
Juncus triglumis var. albescens	-	G5T5SU	
Kobresia simpliciuscula	watch	G5	S1
Koenigia islandica	-	G4	S1
Mimulus suksdorfii	-	G4?	S1
Penstemon whippleanus	-	G5	S1
Potentilla brevifolia	-	G4	S1
Potentilla diversifolia var. multisecta	-	G5T3T4	SH
Ranunculus jovis	sensitive	G4G5	S1S2
Salix cascadiensis	-	G4G5	S1
Salix wolfii var. wolfii	sensitive	G4T4	S1
Sidalcea oregana	-	G5	S1
Thlaspi parviflorum	sensitive	G3	S2
Townsendia condensata	-	G3	S2

* Information concerning occurrences of any of these species is available through the Data General.

¹ "G" rank refers to global rank and "S" rank refers to state rank. For global and state ranks, the numerical categories correspond to the following:

- 1 critically imperiled
- 2 imperiled
- 3 vulnerable
- 4 potentially secure
- 5 secure

RESULTS

SUMMARY

New information was obtained on nine target species from fieldwork and herbarium work, providing a basis for re-examining their current status (Table 2). A historical occurrence of *Sidalcea oregana* was relocated in Hyalite Canyon, and is recommended for addition to the U.S. Forest Service sensitive species list. New populations were found of *Erigeron flabellifolius* and *Mimulus suksdorfii* but are not recommended for sensitive status. A new population of *Salix wolfii* var. *wolfii* was also found; it is currently recognized as sensitive on the U.S. Forest Service sensitive species list, but this status may warrant re-examination pending annotation of all *Salix wolfii* specimens in Montana to variety. Herbarium work revealed that historical reports of four other species, including *Artemisia norvegica*, *Juncus covillei*, *Potentilla diversifolia* var. *multisecta*, and *Salix cascadiensis*, are probably based on misidentifications or taxonomic discrepancies.

A total of 368 taxa of vascular plants were identified on the Gallatin National Forest (Appendix B). Results from each of the four areas and from the Gallatin National Forest Herbarium search are summarized first, followed by species specific synopses.

1. Bridger Mountains

Despite intensive searches, the historically reported population of *Artemisia norvegica* was not relocated. Plants closely resembling the historical collections of *Potentilla diversifolia* var. *multisecta* were found to be common along the crest of the range, however these plants are probably all *P. diversifolia* var. *perdissecta*. No other target species were found in the Bridger Range and no others are reported. A total of 219 vascular plant taxa were identified.

2. Crazy Mountains

The population of *Erigeron flabellifolius* known from Sunlight Lake in the Crazy Mountains was relocated and another population was discovered on "Glacier Pass." Populations of *Juncus covillei* and *Salix cascadiensis* could not be relocated despite searches at their named localities. A total of 214 plant taxa were identified.

3. Hyalite Canyon

Two subpopulations of *Sidalcea oregana* were located above Hyalite Reservoir; these are probably from the same sites as the historical collections at MONT. A total of 121 plant taxa were identified in the canyon.

4. Upper Gallatin Valley

One target species not previously known from the Gallatin National Forest was discovered. A population of *Mimulus suksdorfii* was found on dry talus slopes across the river from Snowflake Spring. This minute annual has been found this summer to be far more common in Montana than previous reports indicated. A total of 16 populations are now known from the state, and the probability of many more is high. The species often grows on talus slopes which are inherently protected, and it is adapted to disturbance. Thus, it was recently recommended that this species be dropped from the list of Montana plant species of special concern (Vanderhorst and Lesica 1994). The species does not merit special attention from the Forest Service, and is not treated further in this report except for a map of the occurrence in Appendix C.

In addition, two populations (or subpopulations of an extensive occurrence) of *Salix wolfii* var. *wolfii* were found along Taylor Fork. No new occurrences of *Castilleja gracillima* were found. The latter species grows with *Salix wolfii* near Snowflake Spring, but was not found in similar wetland habitat along Taylor Fork. Further information on the taxonomy, description, biology, and Gallatin National Forest occurrences of *C. gracillima* is provided by Mathews (1989). Close-up and habitat slides of *C. gracillima* are included in Appendix D of this report (slides 1 and 2).

5. Gallatin National Forest Herbarium Search

Two specimens of target species were found, and the *Salix wolfii* specimen was annotated to variety. Complete label information follows:

Draba ventosa, "First Record for Montana", Madison County, Gallatin National Forest, Bell Lake, on dam; 9,500 ft. elevation; level, gravelly clay loam, dry; open alpine where soil had been broken 3 years ago, scarce. J. C. Whitham #937, 6-19-31, U.S.F.S Herbarium # 66038.

Salix wolfii, Montana, Gallatin County, Gallatin National Forest, Lower Taylor Fork; 7,000 ft. elevation; moist sandy clay loam; browse, 5/10 density; with other salices and carices; light use; along streams; common; forage value: 30-70, for Elk: 60-70; plants 4-5 feet high. Eric P. White # 1119, 6-20-32, U.S.F.S. Herbarium # 69760.

The only "Bell Lake" in the Montana place names gazeteer is in the southern end of the Tobacco Roots Range, now located in Beaverhead National Forest, and it is an impounded lake. *Draba ventosa* is also known from the Madison Range. The collection of *Salix wolfii* var. *wolfii* specimen is probably from the same location where I found the species along the Taylor Fork.

Table 2. Status recommendations for Montana Plant Species of Special Concern known on the Gallatin National Forest

<u>Scientific name</u>	<u>Recommended USFS status</u>	<u>Recommended Heritage rank</u>
<i>Artemisia norvegica</i>	not on Gallatin	Check Glacier NP spec. for validity
<i>Draba ventosa</i>	sensitive (on Beaverhead Natl. Forest)	keep as S1
<i>Erigeron flabellifolius</i>	-	keep as S3
<i>Juncus covillei</i>	not on Gallatin	get MT specimens annotated to var. to determine ranks
<i>Mimulus suksdorfii</i>	-	Delete
<i>Potentilla diversifolia</i> var. <i>multisecta</i>	not on Gallatin	Pursue tax. review w/Ertter
<i>Salix cascadiensis</i>	probably not on Gallatin	keep as S1
<i>Salix wolfii</i> var. <i>wolfii</i>	review	get MT specimens annotated to var.
<i>Sidalcea oregana</i>	sensitive	keep as S1

SPECIES INFORMATION

The remainder of this section is devoted to information on individual species. Descriptions are given of each. For those species which were located and surveyed, information is given on geographical distribution, habitat, and population biology. For those species which were searched for but not found, information is limited to geographical distribution, including reported occurrences on the Gallatin National Forest. Management considerations are discussed for each species.



Artemisia norvegica Fries var. *saxatilis* (Bess.) Jeps.
Boreal wormwood

A. DESCRIPTION

1. General description: This is an herbaceous "sagebrush" or "wormwood" in the Asteraceae (sunflower family). The pinnately dissected leaves are mostly basal with leaves becoming progressively smaller up the stem. The flower heads are relatively few and large compared to other species in the genus.

2. Technical description (quoted from Cronquist 1955):

Perennial from a branching caudex, 2-6 dm tall; herbage from loosely and copiously villous to essentially glabrous; basal leaves tufted and persistent, petiolate, the broad, pinnately dissected blade 2-10 cm long, the ultimate segments narrow and acute; cauline leaves progressively reduced, becoming sessile; inflorescence spiciform or loosely racemiform to narrowly paniculiform; heads relatively large and many-flowered, the disk up to 1 cm wide, the involucre 4-7 mm high, with glabrous or moderately woolly-villous, prominently dark margined bracts; disk corollas long-hairy near their junction with the commonly glabrous achene, often more or less densely villous-hirsute above as well; receptacles hairless.

3. Diagnostic characters: Differs from other perennial herbaceous species of *Artemisia* in Montana by 1) hairless receptacles, 2) large flower heads, and 3) leaves which are primarily basal and generally highly (2-3 times) divided.

B. GEOGRAPHIC DISTRIBUTION

1. Species range: Circumboreal; var. *saxatilis* is in North America, south in the mountains to California and Colorado (Cronquist 1955).

2. Distribution in Montana: The species is known in the state only from historical collections from Glacier National Park and the Bridger Range.

3. Occurrences on the Gallatin National Forest: This element was not relocated in the Bridger Mountains, nor was it seen elsewhere on the Forest. It is reported in the Bridgers based on a collection deposited at the herbarium at the University of Washington, Seattle (WTU). Dr. J. Rumely (MONT) told me he thought this species occurred in the Bridgers in the lower krumholtz zone of the glacial cirque above Fairy Lake. The entire cirque was searched on three dates but only the common *Artemisia michauxiana* was found. At early stages, before the flowering stems elongate, this species might be mistaken for *A. norvegica*. In the fall, the historical collection was

requested on loan. The H. B. Mills collection at WTU was a specimen labeled *Artemisia aromatica* A. Nels., but it was filed under *A. norvegica*. The label data gives a collection date of August 20, 1938 and a locality of Fairy Lake, in contrast to the information on the Element Occurrence Record (EOR), which gives a collection date of August 20, 1958 and a locality of Fairy Creek for a *A. norvegica* specimen at WTU. I believe that these discrepancies are transcription errors and that the EOR refers to the 1938 specimen from Fairy Lake. *A. aromatica* is apparently a synonym for *A. dracunculus* (Weber and Wittman 1992) but the collection is, in fact, *A. michauxiana*, having stems with divided leaves (vs. entire leaves in *A. dracunculus*) and smaller flower heads than *A. norvegica*. Thus, the reported occurrence of *A. norvegica* in the Bridger Range may be based on errors in identification and/or filing. There is some possibility that Mills collected more than one species of *Artemisia* in the vicinity of Fairy Lake or Fairy Creek, but this was not found at WTU. Mill's collection is not numbered, nor does the EOR give a WTU accession number (139480).

C. MANAGEMENT CONSIDERATIONS

A. norvegica has not been documented in the Bridger Mountains, although Rumley's recollection of it may constitute a report. The basis for the other historical record of *A. norvegica* in the state (Glacier Park) should also be checked. This species should be looked for in the high mountains of the state as it occurs both to the north and south. A number of circumboreal species which occur as far south as Colorado seem to skip Montana. This distribution pattern remains to be explained; it may be that appropriate alpine habitat in Montana is limited. Alpine habitats are generally considered the most pristine, but increased recreational use of the high country and grazing are potential threats here. The high subalpine to alpine in the Bridgers is, in most places, not heavily impacted by human-caused disturbance, but this is not always the case in the Crazyes. U. S. Forest Service sensitive status is not appropriate for *A. norvegica*, but watch status may be justified if its occurrence in Montana is documented.

Erigeron flabellifolius Rydb.
Fan-leaved daisy

A. DESCRIPTION

1. General description: This is a low-growing daisy (Asteraceae) adapted to growing in talus. Plants grow from flexible, branched underground stems. The leaves are fan shaped and lobed. The flower heads contain numerous tubular disk flowers surrounded by a series of showy white to light pink ray flowers. Slide 3 in Appendix D is a close-up of plants in bud.

2. Technical species description (quoted from Cronquist 1955):

Perennial with a slenderly branched, diffuse caudex; herbage densely glandular, nearly or quite without long hairs; stem less than 1 dm tall; basal leaves 1-4 cm long, cuneate-flabelliform, deeply 3- to 5-cleft into cuneately 3-lobed divisions, or simply 5- to 9-lobed at the apex; cauline leaves smaller and less divided, the uppermost entire; heads solitary, the disk usually 10-15 mm wide; involucre 7-8 mm high, densely glandular; rays mostly 50-70, light pink or white, about 6-8 mm long and 1.5-2 mm wide; pappus simple, of about 20 bristles.

3. Diagnostic characters: Only a few species of *Erigeron* in Montana have lobed leaves. *E. flabellifolius* is separated from the rest by having cuneate-flabelliform (triangular-fan shaped) leaves with relatively broad segments. The common *E. compositus* may occur in the same habitat but has ternately (1-4 times) lobed leaves with linear segments and a more stout caudex.

B. GEOGRAPHIC DISTRIBUTION

1. Species range: restricted to the high elevation mountains of northwestern Wyoming and adjacent Montana (Hitchcock and Cronquist 1973).

2. Montana distribution: Absaroka Mountains, Beartooth Mountains, Crazy Mountains (Lesica and Shelly 1991).

3. Occurrences on the Gallatin National Forest: Prior to this project *E. flabellifolius* was known from three sites on the Gallatin National Forest, one on the West Boulder Plateau in the Absaroka Range, and two in the Crazy Mountains. I found the species in the Crazies at two locations, one near the previously known population above Sunlight Lake, and one just east of the Glacier Lake/ Twin Lakes Divide (hereafter called "Glacier Pass"). I searched for the known occurrence above Trespass Creek but could not relocate it; it is probable that the plants would not have been recognizable at the early date

(July 21) of this search. EOR's and maps for the populations which were found are included in Appendix C.

C. HABITAT

This species grows in talus, often where no other plants will grow. The two populations surveyed were on recently glaciated north facing mountain slopes above 9,000 feet elevation. Plants were seen in talus varying from fine and loose to coarse and stable, and also grew in cracks between large rocks, and in poorly developed gravelly clay soils. The slopes of microsites ranged from level to extremely steep. Associated plant species, when they occurred, included *Erigeron compositus*, *Phacelia hastata*, *Lomatium cous*, *Astragalus alpinus*, *Saxifraga bronchialis* and *Silene acaulis*. Slide 4 in Appendix D shows the habitat at the "Glacier Pass" site.

D. POPULATION BIOLOGY

The population around Sunlight Lake is extensive. When the occurrence was first discovered by Lackschewitz in 1980 on slopes north of the lake, the species was described as "locally very common." I also found it to be common on slopes south of the lake and estimate there are greater than 10,000 aerial stems covering over 100 acres. Unexplored potential habitat is even more extensive in the vicinity and in the Crazyes in general. The population on Glacier Pass was not completely surveyed due to strong winds and snow (August 13), but here too there is a huge amount of potential habitat, much of it essentially inaccessible. In middle August of the very cold, wet season, plants were at an early flowering stage at Sunlight Lake, but were still vegetative or in bud at the higher elevation Glacier Pass site. Many plants probably did not produce mature fruit in 1993, because the range was covered with heavy snow by late August. Vegetative reproduction is probably common due to the underground branching habit. Specimens were collected with nearby aerial rosettes connected underground, but the full size of individual plants was not determined.

E. MANAGEMENT CONSIDERATIONS

This species occurs in habitats that are inherently well protected and poorly explored. There are extensive areas of potential habitat for the plant in the Crazy Mountains, and it is probably common in the range, as it is in the Beartooth Mountains (Lesica and Shelly 1991). There is no apparent threat to either of the populations seen. No special Forest Service status is recommended for *E. flabellifolius* but due to its narrow geographic distribution it should continue to be tracked, as a low priority, by the Montana Natural Heritage Program, in coordination with the Heritage Program in Wyoming.

Juncus covillei Piper
Coville's rush

A. DESCRIPTION

1. General description: This is a rhizomatous, grass-like rush (Juncaceae). Rushes are distinguished from other graminoids by having lily-like flowers with six more or less similar perianth parts. *J. covillei* has flat leaves and its mature capsules are nearly as long or longer than the relatively short perianth.

2. Technical species description (quoted from Hitchcock et al. 1969):

Strongly rhizomatous perennial mostly 0.5-2(2.5) dm tall, the stems slightly flattened; leaves flattened, 2 to 4 per stem, the blades grasslike, the sheaths with narrow membranous margins that usually project into linear-acute auricles 0.5-1.5 mm long; inflorescence of 1-5(6) discrete heads, sometimes equaled or exceeded by the upper leaves or the foliaceous involucre bract, mostly 3- to 7-flowered; perianth 3-4 mm long, pale to deep brown, the segments ovate-oblong, broadly scarious-margined, minutely papillate-roughened, the outer series rounded to acute and short-mucronate, the inner series as long or slightly shorter, rounded or rarely slightly acute but not mucronate; stamens 6, the anthers mostly 1-1.2(0.8-1.4) mm long, from longer to shorter than the filaments; capsule cylindric-ovoid, rounded and usually retuse at the tip, exceeding the perianth by as much as 1 mm, usually dark brown; style about 1 mm long; seeds barely 0.3 mm long, obliquely cylindric-ovoid, semi-truncate, but minutely apiculate at each end, faintly reticulate.

Note: Two varieties of *Juncus covillei* are present in Montana, *J. c. var. covillei* and *J. c. var. obtusatus*. The former is primarily in lowlands and the latter is montane. Most Montana specimens, as with the putative Gallatin National Forest specimen, have not been identified to variety. Both varieties are apparently rare in the state. Annotation to variety is warranted.

3. Diagnostic characters: The following combination of characters are used to key out *J. covillei* in Montana (Dorn 1984): Perennial

Leaf blades flat, not septate

Heads 3-12 flowered

Flowers subtended by a single bract, not by a pair of bracteoles

Perianth segments 2.5-4 mm long, membranous margined

Seeds lacking appendages

B. GEOGRAPHIC DISTRIBUTION

1. Species range: Along the coast to the Cascades from British Columbia to California, also in Idaho and Montana (Hitchcock and Cronquist 1973, Hermann 1975).

2. Montana distribution: Outside of the Crazies, two varieties of the species are found in northwestern Montana (Lesica and Shelly 1991).

3. Occurrences on the Gallatin National Forest: one collection determined as *J. covillei* from Big Timber Canyon in the Crazies (Lackschewitz 10449 at MONTU). The stated location along the Big Timber Creek Trail in section 5 was searched but the species was not found, nor was it found elsewhere. Mature specimens of three species of *Juncus* were collected from Big Timber Canyon; these were *J. confusus*, *J. ensifolius*, and *J. longistylis*. The specimen of *J. covillei* at MONTU was checked by Peter Lesica, and appears to be misidentified. The plants are greater than 2.5 dm tall, the leaves have conspicuous auricles, and the fruits are immature (Lesica, pers. commun.). *J. covillei* is usually less than 2 dm tall and has inconspicuous auricles. The collection at MONTU may be *C. longistylus*, which is close to *J. covillei* in the keys but is taller and has conspicuous auricles. Thus, it appears, as with *Artemisia norvegica* in the Bridgers, that the reported occurrence of *J. covillei* in the Crazies is based on a misidentification.

C. MANAGEMENT CONSIDERATIONS

There is no evidence that *J. covillei* occurs on the Gallatin National Forest, thus it need not be considered in management plans. However, riparian areas in the Crazies are concentrated in areas which are often heavily impacted and should generally be considered sensitive habitats. The seep areas where rushes are found along the Big Timber Canyon Trail are not heavily impacted at present levels of use. These communities should be considered in trail management plans. The trail is centered on a primitive road, and bisects a number of seeps and native wetland plants that are well established along its sides. Other riparian zones on Gallatin National Forest in the Crazies such as the Sweet Grass Creek drainage are heavily trampled by cattle and have been taken over by exotic and weedy species.

Potentilla diversifolia Lehm. var. *multisecta* Wats.
Diverse-leaved cinquefoil

A. DESCRIPTION

1. General description: a relatively small, herbaceous perennial in the Rosaceae (rose family). The mostly basal leaves have stipules, and are pinnately compound with generally 5-7 leaflets, which are toothed to lobed. Leaves are grayish hairy. Smaller leaves are borne on the flowering stems. The flowers consist of a 5 lobed green calyx, 5 yellow petals, and many stamens and pistils. The fruits are achenes.

2. Technical species description (for the species, quoted from Hitchcock and Cronquist 1961):

Perennial with a branching caudex and short thick rootstocks, from sparsely-strigose and greenish, to rather grayish-sericeous, at least on the lower surface of the leaflets; stems usually several, spreading to erect, (1)1.5-4.5 dm tall; leaves mainly basal, the blades with 5 (7) main leaflets, mostly digitate, but not rarely semipinnate or truly pinnate, often with 1 or 2(3-4) much reduced (sometimes entire) leaflets more or less distant from the main ones; leaflets (oblong) oblanceolate to broadly obovate, mostly 1-3(5) cm long, from shallowly triangular-toothed to dissected (almost to the midvein) into narrowly oblong to linear segments; cauline leaves mostly 1 or 2 below the inflorescence; stipules ovate-lanceolate, 1-2 cm long, usually entire; cymes open, many flowered; calyx saucer-shaped, villous-sericeous, up to 1.5 cm broad in fruit, the lobes triangular-lanceolate, (3)4-6 mm long; petals yellow, obcordate, (4)6-9 mm long; stamens usually 20; pistils numerous; style slender, equaling or exceeding the fruit and subapically attached to it; achenes 1.3-1.6 mm long, ultimately weakly reticulate.

3. Diagnostic characters: Var. *multisecta* is separated from other varieties of the species by having pinnately compound leaves (vs. digitate leaves of the typical variety) which are coarsely grayish strigose (vs. greenish sericeous to glabrate for var. *perdissecta*) and have nearly linear leaflet segments (Hitchcock and Cronquist 1973).

B. GEOGRAPHIC DISTRIBUTION

1. Range of the variety: "occasional in Idaho and Montana to common in Utah and Nevada (Hitchcock and Cronquist 1973)."

2. Distribution in Montana: Known only by historical records from the Bridger, Big Belt and Crazy Mountains.

3. Occurrences on the Gallatin National Forest: Two records from the Forest are entered in the Biological Conservation Database, one from Horsefly Pass in the Crazy Mountains, the other on Mt. Bridger in the Bridger Range. These are based on old (1902 and 1903 respectively) J. W. Blackenship collections at MONT which are labeled *P. multisecta*. Plants which I collected from Mt. Bridger and from the vicinity of Sacagawea Peak closely resemble these historical collections, however, all of these plants, and all other pinnate leaved specimens of *P. diversifolia* at MONT, key out to var. *perdissecta*, with sparsely hairy, greenish leaves. A Rydberg and Bessey collection from the Bridgers, morphologically similar to Blackenship's collections, is also at MONT; this is labeled *P. decurrens* Rydb., a synonym for *P. diversifolia* var. *perdissecta*. The type collection of *P. decurrens* came from the "Spanish Peaks, Madison Range, Montana" (Hitchcock and Cronquist 1961). My impression is that pinnate leaved forms of *P. diversifolia* in the Bridgers are best described as *P. diversifolia* var. *perdissecta*. All of my *Potentilla* specimens were sent to Barbara Ertter (University of California - Berkeley) who is currently working on a revision of the genus. She is not willing, at this point, to make determinations of these specimens (or to concur with mine), and feels that past treatments may not adequately describe the variation in this group. While the Gallatin National Forest material seems to align with *P. diversifolia* var. *perdissecta*, further taxonomic work is needed. The two records of *P. diversifolia* var. *multisecta* will be removed from the Biological Conservation Database as invalid entries.

C. HABITAT

P. diversifolia was seen in a broad range of montane to alpine habitats on the GNF. Pinnate leaved forms, however, were found only at higher elevations along the crest of the Bridger Mountains. These plants grew in rocky areas in open, low statured forests (Douglas fir on the west side, Engelmann spruce on the east), and above timber on talus slopes, rock outcrops, and in rocky tundra.

D. POPULATION BIOLOGY

The populations of pinnate leaved *P. diversifolia* were extensive along the crest of the Bridgers. These populations were always intermixed with *P. diversifolia* var. *diversifolia*, and at times with *P. ovina*. Species of *Potentilla* commonly hybridize, forming apomictic clumps (Ertter, pers. commun.). Pinnate leaved "*P. diversifolia*" may represent hybridization with *P. ovina*.

E. MANAGEMENT CONSIDERATIONS

Although Hitchcock and Cronquist (1973) give a Montana distribution for *P. diversifolia* var. *multisecta*, I have seen no collections from the state which match their description or

specimens from the Great Basin. Pinnate leaved forms of *P. diversifolia* grow in rocky habitat on the Bridger Crest which is generally undisturbed and often inaccessible, and populations are extensive. I also collected similar plants from the Anaconda Mountains on the Deer Lodge National Forest. This taxon, which I consider *P. diversifolia* var. *perdissecta*, appears to be common in the higher mountains of Montana and does not warrant U. S. Forest Service sensitive status. *P. diversifolia* var. *multisecta* should be looked for in southwestern Montana; of all the specimens which I sent to B. Ertter, the one she thought most closely approached *P. diversifolia* var. *multisecta* (Vanderhorst 4943) was collected in the Tendoy Mountains in Beaverhead County. I had identified this as *P. ovina* and thought that it approached *P. plattensis*, another target species. Species of *Potentilla* often intergrade, and identification to variety and even to species is often difficult, or even arbitrary. Montana Natural Heritage Program "undetermined" status is appropriate for *P. diversifolia* var. *multisecta* at this time. No special U. S. Forest Service status is recommended for any variety of *P. diversifolia*.

Salix cascadensis Cockerell
Cascade willow

A. DESCRIPTION

1. General description: This is a low creeping alpine willow (Salicaceae). The stems are woody, but grow close to the ground. The leaves are narrow and green on both sides, the old ones persisting on the plant. The flowers are borne in catkins, with male and female on separate plants. The capsules are hairy.

2. Technical species description (quoted from Hitchcock et al. 1964):

Plants with a slender, rhizomatously much-branched caudex from an eventual taproot, forming dense mats on the surface of the ground, the branches eventually becoming thickened and woody; leaves firm, thick, entire, somewhat arachnoid when young, sooner or later glabrate (or the margins persistently pilose), only the midrib and the few primary lateral veins prominent, the blade mostly rather narrowly elliptic and acute, the better developed ones mostly 1-1.5(2.5) cm long and 2.5-5(8) mm wide, on a short petiole 1-3 mm long, some of the leaves becoming marcescent and persistent for one or more years; aments smaller than in *S. arctica*, but larger than in *S. rotundifolia*, appearing with the leaves, short-peduncled at the end of short, leafy lateral branches (the main vegetative shoots not ending in aments); scales dark, persistent, usually conspicuously long hairy, the hairs much surpassing the body of the scale; stamens 2, the glabrous filaments often connate below; pistillate aments mostly 1-2(2.5) cm long at maturity and with 12-25 fruits; capsules 4-5 mm long, villous-tomentulose or rarely glabrous; style well developed, longer than the bilobed stigmas, the style and stigmas together 1-1.5(2) mm long.

3. Diagnostic characters: There are 3 other creeping, high elevation willows in Montana which *S. cascadensis* superficially resembles. It is distinguished from *S. rotundifolia* by having leaves longer than 7 mm and hairy capsules. *S. reticulata* differs in having leaves with rounded tips and prominent veins. *S. arctica* has wider leaves which are glaucous beneath and do not usually persist. (adapted from Dorn 1984)

B. GEOGRAPHIC DISTRIBUTION

1. Species range: "southwestern British Columbia south in the Cascades to Mt. Rainier, Washington, occasionally east to Montana and Wyoming and south to Colorado and Utah, reported in northeastern Oregon (Hitchcock and Cronquist 1973)."

2. Montana distribution: Anaconda, Pioneer, and Crazy Mountains (Lesica and Shelly 1991).

3. Occurrences on the Gallatin National Forest: A 1945 Hitchcock and Muhlick collection (13275), labeled *S. cascadiensis*, from the Crazy Mountains is deposited at the herbarium at the University of Washington (WTU). The location is described on the label as "near outlet of Granite Lake." The vicinity of Granite Lake was searched but the habitat type, subalpine forest with a dry understory, is not appropriate for *S. cascadiensis*. More likely habitat for alpine willows would be above timberline further upstream. *Salix arctica* was found to be common in the alpine in the Crazies but *S. cascadiensis* was not seen. The 1945 collection was taken on loan from WTU. This specimen is problematical, having leaves which are relatively narrow but glaucous beneath and not persisting, thus combining characters of *S. arctica* and *S. cascadiensis*. Although C. R. Ball annotated the specimen as *S. cascadiensis*, my impression is that it is *Salix arctica* with unusually narrow leaves. Material apparently separated from this collection was found at Intermountain Herbarium (INT) in Logan, Utah. This specimen (Hitchcock and Muhlick 13275b) is labeled *S. petrophylla* (a synonym of *S. arctica*) and was also annotated by Ball; it has wide leaves typical of *S. arctica*. I also examined other alpine willows collected by Hitchcock and Muhlick (12962 at INT and 13098 at WTU) from the Pioneer Mountains in Montana, also annotated by Ball as *S. cascadiensis*. These are clearly *S. arctica* (12962 was annotated as such by G. W. Argus in 1991), with relatively broad leaves which are glaucous beneath. Thus Ball's circumscription of *S. cascadiensis* seems rather broad compared to modern treatments (e. g. Dorn 1992). The occurrence of *S. cascadiensis* in the Crazies cannot, however, be entirely dismissed.

C. MANAGEMENT CONSIDERATIONS

If *Salix cascadiensis* occurs in the Crazy Mountains, it is uncommon. If the Hitchcock and Muhlick collection is verified as *S. cascadiensis*, then continued search for this element is justified. Some alpine and sub-alpine habitats in the Crazies are heavily impacted by cattle grazing and recreation, thus any species which is extremely rare and occupies accessible habitat is potentially threatened. Alpine willows are relatively sturdy plants but specimens of *S. cascadiensis* are generally smaller than other species. Other reports of *S. cascadiensis* in Montana should also be investigated by MTHP; occurrences in the Pioneer Mountains may be based on the specimens at INT annotated by Ball. This species is uncommon in Montana, perhaps more so than reports suggest, and should continue to be tracked by the state. Annotation of specimens by a willow scholar (Dorn and/or Argus) is needed to help clarify the species' distribution in the state.

Salix wolfii Bebb var. *wolfii*
Wolf's willow

A. DESCRIPTION

1. General description: This is an upright willow (Salicaceae) of medium height. The leaves are silvery hairy. The flowers are borne in catkins with the male and female on separate plants. The capsules are glabrous. Slide 5 in Appendix D shows the plant. Note: In a recent report to the Gallatin National Forest (Mathews 1989), this variety was mistakenly described as having hairy capsules.

2. Technical species description (quoted from Hitchcock and Cronquist 1964):

Freely branched shrub 6-20 dm tall; twigs of the season rather thinly villous-puberlent; stipules evident, 1-5 mm long, foliaceous in texture, often glandular-serrate, sooner or later deciduous; petioles short, 2-10 mm long; leaf blades entire, usually acute or acutish, more or less elliptic, 3-4.5 times as long as wide, relatively small, up to 4.5 cm long and 1.5 cm wide, or in var. *idahoensis* to 7 cm long and 2 cm wide, sparsely to densely sericeous or sericeous-tomentose, usually grayish with pubescence, more so beneath than above, but not glaucous; aments coetaneous on short, leafy-bracted peduncles, some of the bracts commonly well over 1 cm long; scales dark brown or blackish, persistent, woolly-villous, the hairs much exceeding the body of the scale; staminate aments 1-2 cm long usually under 1 cm thick; stamens 2, with glabrous filaments; pistillate aments 1.5-3(4) cm long at maturity; capsules 3.5-5 mm long, glabrous to moderately villous-puberlent, borne on a short pedicel under 1 mm long; style 0.5-1.1 mm long, longer than the short bilobed stigmas. Variety *wolfii* with glabrous (or occasionally only subglabrous) fruits... var. *idahoensis* Ball, with somewhat hairy capsules, and averaging a little more robust in all measurements...

3. Diagnostic characters: The following combination of features is used to key out *S. wolfii* in Montana (Dorn 1984):

erect shrub
twigs not pruinose
leaves not linear, about equally green on both sides
capsules 0.8-2 cm long, stipes 0-0.8 mm long, styles 0.2-1.3 (1.5) mm long

Dorn (1992) does not recognize varieties of *S. wolfii*. Apparently, the only feature separating the varieties is the

vestiture of the capsules (Dorn, pers. commun.), thus male and vegetative plants cannot be identified to variety.

B. GEOGRAPHIC DISTRIBUTION

1. Species range: "northeastern Oregon and northern Nevada to southwestern Montana and Colorado (Hitchcock and Cronquist 1973)."

2. Montana distribution: Lesica and Shelly (1991) give a state distribution in the Gravelly and Anaconda Ranges in Deerlodge and Madison Counties. Mathews (1989) documented the occurrence of the taxon in the Gallatin River drainage on the GNF in Gallatin County.

3. Occurrences on the Gallatin National Forest: Prior to 1993, two occurrences of *Salix wolfii* var. *wolfii* from the Forest were entered on the BCD, both from the upper Gallatin Valley (Cinnamon Creek and Snowflake Spring). More information on these populations can be found in Mathews (1989); specimens from both these locations have glabrous capsules (Mathews, pers. commun.). In addition to these, I found the variety growing along Taylor Fork (EORs and maps in Appendix C). An old specimen from Taylor Fork was also found in the GNF herbarium (see label data on page 8). This taxon was also found in 1993 by Jim Jacobs on the Hebgen Lake District (Cherry, pers. commun.).

C. HABITAT

The two populations which I visited (Snowflake Spring and Taylor Fork) occurred in wet floodplains dominated by willows (*Salix boothii*, *S. drummondiana*, *S. exigua*, and *S. geyeri*) and birch (*Betula glandulosa*). Herbaceous associates included *Habenaria hyperborea*, *Pedicularis groenlandica*, *Sisyrinchium idahoense*, and species of *Carex* and *Juncus*. These habitats are used heavily by wild game (elk, moose). Slides 6 and 7 in Appendix D show the habitat of *S. wolfii*.

D. POPULATION BIOLOGY

The populations are extensive. Along the Gallatin River near Snowflake Spring and along the lower Taylor Fork, *S. wolfii* is scattered and other species of willows are more common, but at least 1,000 aerial stems were estimated at each site. Most of the plants were vegetative, but a few plants with mature capsules were found (July 10). Further up the Taylor Fork at its confluence with Wapiti Creek, *S. wolfii* is dominant (see slide 33 in Appendix C). Here it forms low, dense thickets (estimated 10,000+ stems, dominant over 20 acres). No fruiting plants were found; it is assumed to be var. *wolfii*, but this cannot be proved. All of the willow species at these sites are heavily browsed by game, and are thus low statured. Slide 31 in Appendix C shows willows, including *S. wolfii*, both inside and outside of an enclosure along the Gallatin

River across from Snowflake Spring. Reproduction at these sites is probably primarily vegetative. Heavy browsing seems to affect only the stature of the plants, not their occurrence or density.

E. MANAGEMENT CONSIDERATIONS

The populations which I visited are heavily browsed by game but appear to withstand this use. Likewise, human impacts by recreation (fishing, hiking, horseback riding, camping), at their current levels, do not seem to threaten these occurrences. *Salix wolfii* was not seen (and is not known) on the GNF outside of the upper Gallatin Valley, and has a limited distribution elsewhere in the state. Since both varieties are reported from Montana, clarification of their distributions and relative abundance is needed. No recommendations on this species' conservation status can be made until complete distribution records (including Jim Jacobs' 1993 discoveries) are reviewed.



Sidalcea oregana (Nutt. ex T. & G.) Gray
Oregon checker-mallow

A. DESCRIPTION

1. General description: This is a large, showy, herbaceous perennial in the Malvaceae (mallow family). The leaves usually vary on the same plant from nearly round and shallowly lobed at the base to deeply palmately lobed or compound on the tall flowering stems. The flowers are borne in showy racemes and have five sepals, five pink-purplish petals, and many stamens whose filaments form a tube around the pistil. The fruit is composed of segments which separate and are arranged around an axis, somewhat like a cut pie or round of cheese. See slides 8 and 9 in Appendix D.

2. Technical species description (quoted from Hitchcock and Cronquist 1961):

Perennial from a stout taproot and branched crown, but without rootstocks; stems 2-15 dm tall, from glabrous to hirsute or stellate below, finely stellate above; racemes simple to compound, from closely many-flowered and spikelike to open and lax, the pedicels 1-10 mm long; calyx 3.5-9 mm long, from uniformly finely stellate to bristly with a mixture of longer, simple to 4-rayed, spreading hairs sometimes as much as 2.5 mm long; petals 1-2 cm long, light pinkish to fairly deep watermelon pink; carpel 2.5-3 mm long, from nearly smooth to reticulate-alveolate on the sides and back; beak 0.3-0.7 mm long.

3. Diagnostic characters (adapted from Hitchcock and Cronquist 1973): stigmatic surfaces along the lengths of the style branches, not capitate; filaments connate in groups of 2-6; leaves dimorphic, nearly orbicular shaped to deeply palmately lobed but not shaped like maple or grape leaves. The leaf shape can be used to easily distinguish this species (even vegetatively) from *Iliamna rivularis*, a member of the Malvaceae which is common along Hyalite Creek.

B. GEOGRAPHIC DISTRIBUTION

1. Species range: from central Washington to California, east to Wyoming and Utah (Hitchcock and Cronquist 1973) and Montana.

2. Montana distribution: known only from Hyalite Canyon in Gallatin County and the Mission Valley in Lake County.

3. Occurrences on the Gallatin National Forest: I found two subpopulations in Hyalite Canyon, one just above Hyalite Reservoir, the other slightly further upstream in the meadow below Window Rock Forest Station. Prior to this project, the

occurrence of this species in Hyalite Canyon was known from 4 specimens (plus duplicates) at MONT collected between 1888 and 1957. The labels on these specimens give locations of "Upper Middle Creek", "West Fork Middle Creek", "Chisholm's Camp" and "Hyalite Canyon, open meadow above lake." On the 1955 USGS Fridley Peak Quadrangle (15 minute series) "Chisholm Cabin" is shown just above the Reservoir, close to the present Forest Service "Chisholm" campground and within 1/2 mile of the population of *S. oregana* which I found. Middle Creek is an old name for Hyalite Creek and its "West Fork" or "Upper" section would also refer to the section of Hyalite Creek above the Reservoir. The statement "probably below Hyalite Reservoir" on the EOR printout for the historical record seems to be an error. Intensive searching of the entire canyon, especially below the Reservoir, revealed no other sites for this element. The evidence suggests that all of the collections at MONT came from the same population which I found, and that the distribution of *S. oregana* in Hyalite Canyon is limited to this population. An Element Occurrence Record printout and map are included in Appendix C.

C. HABITAT

The population of *S. oregana* occurs in natural montane meadows and the adjacent meadow/forest and meadow/willow thicket ecotones. The meadows are dominated by forbs and are an uncommon vegetation type within Hyalite Canyon; most openings in the valley are man-made clearcuts. The adjacent forest is dominated by *Picea engelmannii* and *Pinus contorta*. Common native forbs in the meadows include *Perideridia gairdneri*, *Campanula rotundifolia*, *Delphinium occidentale*, *Fragaria virginiana*, *Senecio crassulus*, and *Lupinus argenteus*. Common native grasses include *Bromus carinatus* and *Melica spectabilis*. There is also a high density of exotic forbs and grasses, especially at the upstream subpopulation; these include *Cirsium arvense*, *Phleum alpinum*, *Bromus inermis*, *Poa pratensis* and *Trifolium repens*. Perhaps the most distinctive feature of the habitat is the soil, which is an extremely heavy red clay that dries to almost the hardness of brick, but is probably moist for most of the season. *S. oregana* was not found in natural meadows upstream which lacked this soil. Neither was the species found under closed forest canopies or in adjacent wet meadows dominated by sedges. In the Mission Valley, *S. oregana* grows around the glacial potholes in a zone just uphill from the willow zone (*Lesica*, pers. commun.). Slides 10 and 11 in Appendix D show the habitat of the upstream and downstream Hyalite Canyon subpopulations respectively.

D. POPULATION BIOLOGY

The upstream subpopulation is extremely dense, with over 10,000 estimated aerial stems covering about 15 acres. *S. oregana* is perhaps the dominant species in this meadow,

forming mass stands (see slide 11 in Appendix D), and competing successfully with *Cirsium arvense* (Canada thistle). The plants were heavily browsed in patches, probably by wild game. The subpopulation just above the reservoir was estimated to consist of over 5,000 aerial stems covering about 10 acres. Plants were more scattered in this subpopulation, were less heavily browsed, and a more significant number were small and vegetative. On the survey date of August 17 plants at both populations were flowering with some immature fruit developed. There is some question whether or not this species reproduces vegetatively. Welsh et al. (1987) state that it is "lacking, or rarely with rhizomes." The dense stands of the upstream subpopulation suggest clonal reproduction, especially considering the high levels of inflorescence predation and infestation of the habitat by rhizomatous weeds. Excavation of underground plant parts was extremely difficult due to the hard soil and heavy vegetation cover; no connections between stems were documented.

E. MANAGEMENT CONSIDERATIONS

One subpopulation is heavily impacted by browsing and weeds, but the species remains competitive at the site. The other subpopulation occurs in more pristine habitat, but recently a wide path has been excavated across the Hyalite Creek floodplain nearby (see slide 12 in Appendix D). This bare ground may provide a route for weed invasion of the *Sidalcea* habitat. Although the GNF population seems secure at this point, it is limited to a very small area of unique habitat, close to roads and potential development. Considering the species' limited, and oddly disjunct, distribution in Montana, it should continue to be tracked by the MTHP. Forest Service sensitive status is also appropriate. Further searches for *S. oregana* should be conducted in the vicinity, concentrating on natural meadows in the valley above Hyalite Reservoir. Steps should be taken to monitor and prevent weed invasion of the lower population site, and weed control measures should carefully target exotic species in nearby areas.

DISCUSSION

Although these surveys did not reveal any populations of rare plants which are immediately threatened, severe human-caused impacts on the native flora were observed in some areas and habitats on the Gallatin National Forest. Riparian zones, in particular, are often degraded; they are restricted in area and receive concentrated use by livestock and recreationists, often resulting in trampled vegetation, bare ground, erosion, and infestations of exotic and weedy taxa. Plant communities over larger areas have also been impacted and homogenized by heavy grazing, logging, and development of roads, dams and ski slopes. Typically, large scale disturbances are concentrated at lower and middle elevations, however, higher elevations are increasingly impacted by recreation and in some cases the alpine has been grazed by cattle with devastating effects on the vegetation.

The checkerboard landownership pattern in the Crazy Mountains, with its effects on land use, access, and regulation, has resulted in some of the most degraded habitats observed among the study areas. Recreational impacts on vegetation are particularly intense around easily accessed lakes in the upper Big Timber Creek basin (e.g. Blue, Granite, and Twin Lakes), while grazing has resulted in severely altered landscapes from the montane to the alpine along Sweet Grass Creek. Management to reduce these pressures and to reclaim the native vegetation in these areas should be implemented. Preservation of large areas with intact native floras, such as Sunlight Lake basin (already mostly on the GNF), should be a priority for land exchanges and acquisition and for Wilderness designation. Examples of such pristine habitats at lower elevations also need to be located and preserved.

Botanically, the Crazy Mountains are one of the least explored ranges in Montana. Although few rare plants are known from the range, further surveys are warranted, especially considering the heavy use which some areas receive. My survey in the range was extremely limited in scope, being confined to some of the best traveled routes and targeting historically reported species. The extremely wet, cold growing season of 1993 also limited the project's effectiveness by reducing accessibility and travel speed to the range and by delaying plant development. A general floristic inventory of the entire range, including the lower elevations, would be useful as a first step in identifying sensitive plants and habitats. Thesis work in the Flat Tops and White River Plateau in Colorado (Vanderhorst 1993) demonstrates the utility of this approach. Prior to floristic survey of this area, four Colorado Plant Species of Special Concern were known. In the course of two summers' fieldwork,

these four and an additional seven target species were found. Thus, historical records do not necessarily provide a complete picture of plant diversity, especially in poorly explored areas. Floristic inventories can often be conducted at reasonable expense through cooperative ventures with universities and graduate students (e.g. Montana State University or University of Wyoming).

Botanical surveys do not always increase the number of rare plants known from an area, as demonstrated by this project. Historical records of as many as four target species on the Gallatin National Forest were found to be based on misidentifications or taxonomic discrepancies (see synopses for *Artemisia norvegica*, *Juncus covillei*, *Potentilla diversifolia* var. *multisecta*, and *Salix cascadiensis*). It seems that these plants probably do not occur on the Forest. However, while occurrences can be proven, absences are nearly impossible to prove. In addition, taxonomic questions remain concerning the last two of these taxa. The importance of herbarium work in evaluating historical occurrences cannot be overemphasized. Examining actual specimens can help reconcile taxonomic and transcription errors, as well as give clues to geographic locations and habitats.

In addition to the nine species whose status is reviewed in this study, there are six sensitive species, three watch species, and 17 other Montana species of special concern from Gallatin National Forest which this study did not address. At least seven are known only by collections before 1950. One of these, *Erigeron eatonii* was recently searched for but not found (Mathews 1989); it is not known otherwise in Montana. Another, *Penstemon whippleanus*, was located last summer in the Centennial Mountains (Culver 1993), the second time it has been seen in the state since its discovery in 1946 on the Gallatin National Forest, where it remains to be relocated. *Drosera anglica*, a species confined to "pristine bogs" (Lesica and Shelly 1991), was collected on the Gallatin National Forest in the Spanish Peaks area in 1943. Relocation of this species should be given priority because riparian areas on the Forest are often heavily impacted and bogs are an unusual habitat type. The other four species on the Forest which have not been documented since 1950 include: *Allium simillium*, *Carex neurophora*, *Epilobium suffruticosum*, and *Thlaspi parviflorum*. They are all given an S1 state rank and are known from elsewhere in Montana, but their status on the Gallatin National Forest needs to be resolved. None of these species are on the Forest Service sensitive list and are thus not considered in making land use decisions. Determination of their status and conservation needs should be a priority for future botanical research on the Gallatin National Forest.

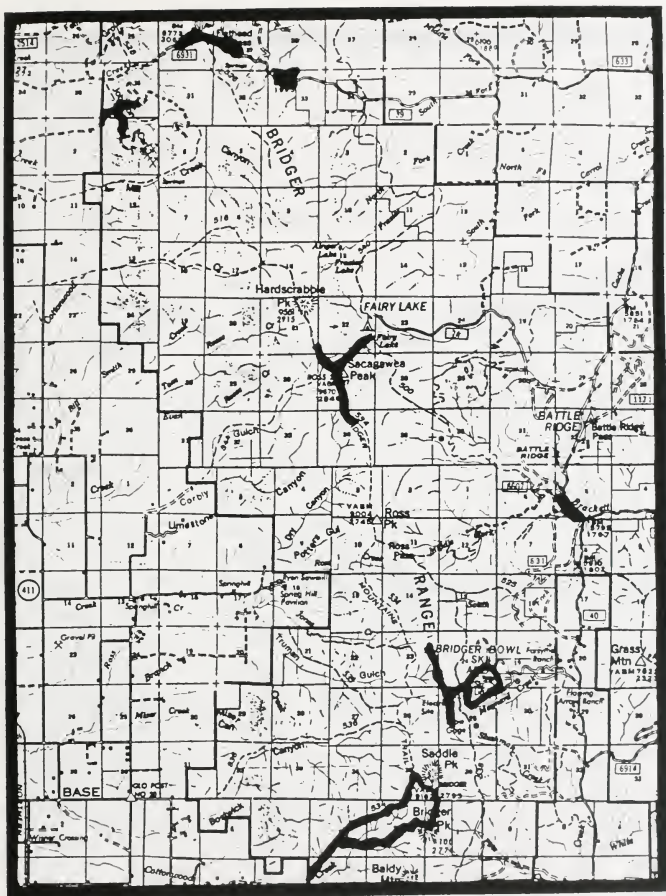
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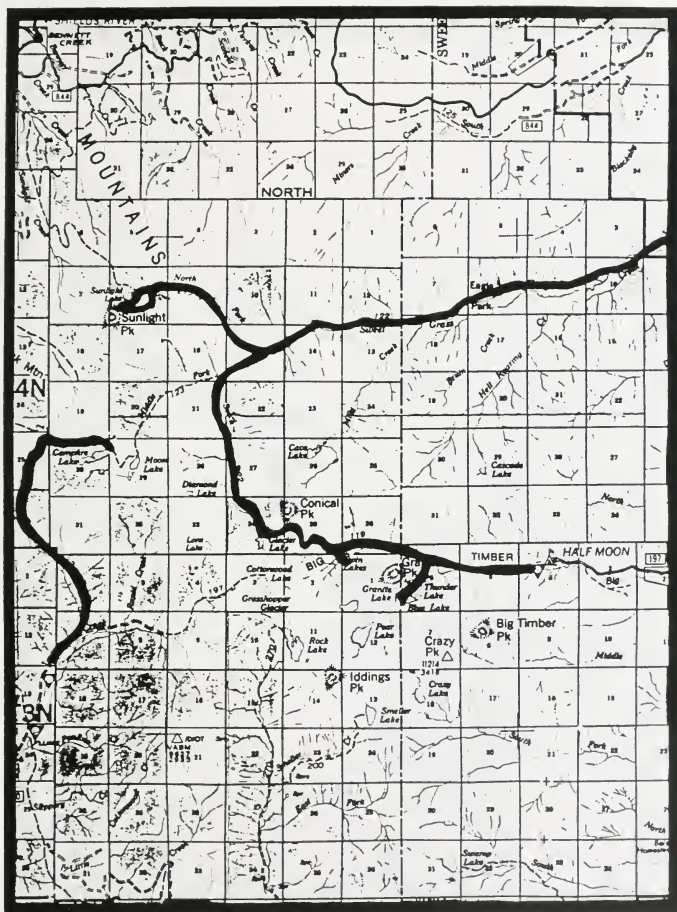


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APPENDIX A. Maps showing primary travel routes.



The Bridger Mountains



The Crazy Mountains



Hyalite Canyon



Upper Gallatin Valley

APPENDIX B. List of vascular plant taxa identified on the Gallatin National Forest, July and August, 1993. * = introduced taxon, # = collected, specimen deposited at MONT, bold = Montana Plant Species of Special Concern; B = Bridger Mountains, C = Crazy Mountains, G = upper Gallatin Valley, H = Hyalite Canyon. Nomenclature follows Dorn (1984). When other names were used on herbarium labels, and in a few other cases, synonymy is given. 368 total.

Aceraceae		*Cirsium vulgare	H		
Acer glabrum	B, C	Crepis runcinata	C		
		Erigeron compositus	B, C		
		#Erigeron flabellifolius	C		
Apiaceae		#Erigeron ochroleucus	B, C		
Angelica arguta	C, H	Erigeron peregrinus	C, H		
Angelica roseana	G	#Erigeron simplex	C		
#Bupleurum americanum	B, C	#Erigeron ursinus	C		
Cymopterus bipinnatus	B, G	Eriophyllum lanatum	G		
Heracleum sphondylium	B, C, G, H	Gaillardia aristata	B, C		
Lomatium ambiguum	B, C	Haplopappus acaulis	B		
Lomatium cous	B, C	Helianthella uniflora	B, C		
Lomatium dissectum	B, C, H	Hieracium albiflorum	C, H		
Osmorhiza depauperata	B, C, H	#Hieracium aurantiacum	C		
Osmorhiza occidentalis	B, C	Hieracium cynoglossoides	C		
#Perideridia gairdneri	H	Hieracium gracile	C		
		#Hulsea algida	C		
		#Microseris nutans	B, C		
Apocynaceae		Rudbeckia occidentalis	H		
Apocynum androsaemifolium	B, H	Senecio canus	B, C, G, H		
		Senecio crassulus	B, H		
		Senecio freemontii	B, C		
Asteraceae		Senecio pseud aureus	B, G, H		
Achillea millefolium	B, C, G, H	Senecio serra	B, C, G		
		Senecio triangularis	B, C, H		
		*Taraxacum laevigatum	H		
		*Taraxacum officinale	C		
		#Townsendia parryi	B		
		*Tragopogon dubius	B, C, H		
		*Tragopogon pratensis	B		
		Berberidaceae			
		Arnica cordifolia	B, C, H	Mahonia repens	B, C, G, H
		Arnica fulgens	B	Betulaceae	
		Arnica latifolia	B, C	Alnus incana	B, C, H
		Arnica parryi	B, C, H	#Betula glandulosa	G
		#Arnica rydbergii	B	Betula occidentalis	B
		Artemesia campestris	C	Boraginaceae	
		Artemesia cana	G	*Cynoglossum officinale	B, C, G, H
		Artemesia frigida	C, G	Eritrichium nanum	B, C
		Artemesia ludoviciana	B, C	Hackelia floribunda	H
		#Artemesia michauxiana	B, C	Hackelia micrantha	B, C, H
Artemesia tridentata	B, C, G				
Balsamorhiza sagittata	B, C				
*Carduus nutans	C, H				
*Chrysanthemum leucanthemum	H				
*Cirsium arvense	B, C, G, H				
Cirsium scariosum	B, G				

Hackelia patens	B	Juniperus communis	B, C, G, H
Lithospermum ruderales	B	Juniperus scopulorum	B
#Mertensia alpina	C		
Mertensia ciliata	B, C, G, H	Cyperaceae	
Mertensia viridis	B, C	Carex geyeri	B, C, H
#Myosotis alpestris	B, C	Carex lanuginosa	B
		#Carex raynoldsii	C
Brassicaceae		Carex rostrata (C. utriculata)	B, C, H
*Alyssum desertorum	B	Scirpus microcarpus	B
Arabis drummondii	B, C		
#Arabis nuttallii	B	Eleagnaceae	
*Capsella bursa-pastoris	C	Shepherdia canadensis	B, H
#Cardamine breweri	G		
Descurainia richardsonii	B	Ericaceae	
Draba oligosperma	B	Arctostaphylos uva-ursi	B, G, H
#Draba paysonii	B	Cassiope mertensiana	C
Erysimum asperum	B	Chimaphila umbellata	B, C, H
Lesquerella alpina	B	#Kalmia microphylla	C
Physaria didymocarpa	B, G	Orthilla secunda	B, C, H
*Thlaspi arvense	B, C, G, H	Phyllodoce empetrififormis	C
Thlaspi montanum	B, C	Phyllodoce glandulifolia	C
		Pyrola asarifolia	H
Campanulaceae		Pyrola chlorantha	H
Campanula rotundifolia	C, H	Vaccinium membranaceum	B, C, H
		Vaccinium scoparium	C, H
Caprifoliaceae			
Linnaea borealis	H	Equisetaceae	
Lonicera utahensis	B, C, H	Equisetum arvense	B, C, H
Sambucus racemosa	B, C	Equisetum hymale	H
Symphoricarpos albus	H	Equisetum laevigatum	B
Caryophyllaceae		Fabaceae	
Arenaria congesta	B, C, G	#Astragalus aboriginum	B
#Arenaria nuttallii (Minuartia)	C	Astragalus alpinus	C
#Arenaria obtusiloba (Minuartia)	B, C	Astragalus miser	B, C, H
#Arenaria rossii (Minuartia austromontana)	B	#Hedysarum sulphurescens	B
Cerastium arvense	B, C, G	Lupinus argenteus	B, C, H
*Lychnis alba	C, G, H	Lupinus leucophyllus	B
Silene acaulis	B, C	Lupinus sericeus	B, C, H
#Stellaria americana	B	*Medicago lupulina	B
		*Melilotus officinalis	B, C, H
Chenopodiaceae		Oxytropis cusickii	C
Monolepis nuttalliana	G	#Oxytropis lagopus	B
		Oxytropis sericea	B
Cornaceae		Oxytropis splendens	C
Cornus stolonifera	B, H	#Trifolium haydenii	B, C
		*Trifolium pratense	B, C, H
Crassulaceae		*Trifolium repens	B, C, H
#Sedum integrifolium	B, C	Vicia americana	B
Sedum lanceolatum	B, C, G		
		Gentianaceae	
Cupressaceae		Frasera speciosa	B, C, G
		Gentianella amarella	C
		Geraniaceae	

Geranium richardsonii B, C, G, H
Geranium viscosissimum B, C, G, H

Grossulariaceae

Ribes cereum B
Ribes lacustre B, C, H
Ribes viscosissimum B, C

Hydrophyllaceae

Hydrophyllum capitatum B, C
Nemophila breviflora B, C
Phacelia franklinii G
Phacelia hastata B, C, G
Phacelia heterophylla B, C, H
Phacelia sericea C

Iridaceae

Iris missouriensis B
Sisyrinchium idahoense G

Juncaceae

#Juncus confusus C
#Juncus drummondii C
#Juncus ensifolius C
#Juncus longistylis C
Juncus mertensianus C
#Luzula campestris C, H
Luzula parviflora C, H

Lamiaceae

Agastache urticifolia B
Monarda fistulosa C, H
Prunella vulgaris B, C, H

Liliaceae

Allium brevistylum B, C, G, H
Allium cernuum H
Allium schoenoprasum C
Disporum trachycarpum B
Erythronium grandiflorum B, C
#Lloydia serotina B
Smilacina racemosa B
Smilacina stellata B, G, H
Streptopus amplexifolius B, C, H
Trillium ovatum H
Triteleia grandiflora B
Veratrum viride B, C
Zigadenus elegans B, C
Zigadenus venenosus B, C

Linaceae

Linum lewisii B, G

Malvaceae

Iliamna rivularis H
#Sidalcea oregana H

Onagraceae

Epilobium anagallidifolium C
Epilobium angustifolium B, C, H
Epilobium ciliatum B, H
Oenothera villosa C, H

Orchidaceae

Calypso bulbosa B, H
Corallorrhiza maculata B, C
Corallorrhiza striata B
Corallorrhiza wisteriana B
Goodyera oblongifolia B, C, H
Habenaria dilatata B, C, H
Habenaria hyperborea B, G, H
Habenaria saccata C, H
Habenaria unalascensis B, C
#Listera caurina C
#Listera cordata C
Spiranthes romanzoffiana C

Pinaceae

Abies lasiocarpa B, C, H
Picea engelmannii B, C, G, H
Pinus albicaulis C
Pinus contorta B, C, G, H
Pinus flexilis B, C, G
Pseudotsuga menziesii B, C

Plantaginaceae

*Plantago major C

Poaceae

*Alopecurus pratensis G
Bromus carinatus H
*Bromus inermis B, C, G, H
*Bromus tectorum C
Calamagrostis rubescens B, C, H
*Dactylis glomerata B, C
Danthonia intermedia C
Deschampsia atropurpurea C
Deschampsia caespitosa C
Elymus canadensis C, H
Elymus spicatus (Agropyron) B
Festuca idahoensis B, C, G
Festuca ovina C
Hordeum jubatum H
Koeleria macrantha G
Melica spectabilis B, C, H
Melica subulata B, C
Phleum alpinum B, C, H
*Phleum pratense B, C, H
Poa alpina B, C

#Poa nervosa	B	Trollius laxus	C
#Poa palustris	C		
*Poa pratensis	G	Rhamnaceae	
#Poa secunda	B		
Stipa nelsonii	B	Ceanothus velutinus	B, C, H
Polemoniaceae		Rosaceae	
#Collomia debilis	B	Amelanchiar alnifolia	B
Collomia linearis	B, C, H	Amelanchiar utahensis	H
Linantus septentrionalis	B, C	Dryas octopetala	B
Phlox caespitosa	B	Fragaria virginiana	B, C, G, H
Polemonium occidentale	G	Geum aleppicum	C, G
Polemonium pulcherrimum	B	Geum macrophyllum	B, C
Polemonium viscosum	B, C	Geum rivale	H
		Geum rossii	C
Polygonaceae		Geum triflorum	C, G, H
Eriogonum flavum	B, C	#Ivesia gordonii	B
Eriogonum umbellatum	B, C, G, H	Petrophyton caespitosum	B
Eriogonum ovalifolium	C	Physocarpus malvaceus	B
Oxyria digyna	B, C	Potentilla anserina	G
Polygonum bistortoides	B, C	#Potentilla diversifolia var. diversifolia	B, C
#Polygonum douglasii	B, C, H	Potentilla fruticosa	B, C, G
Polygonum viviparum	B	Potentilla glandulosa	B, C, H
*Rumex acetosella	C, H	Potentilla gracilis	B, C, G, H
Rumex crispus	C, H	Potentilla hippiana	B, C
Rumex occidentalis	B	Potentilla norvegica	C
		Potentilla ovina	B
Polypodiaceae		Prunus virginiana	B
Athyrium filix-femina	C	Rosa woodsii	B, C, G, H
Cheilanthes feei	B	Rubus idaeus	B, C, H
Cryptogramma acrostichoides	C	Rubus parviflorus	B, H
		Sibbaldia procumbens	C
Portulacaceae		Sorbus scopulina	H
#Claytonia lanceolata	B, C	Spiraea betulifolia	B, C, H
Claytonia megarhiza	C	Spiraea splendens	C
#Lewisia pygmaea	C		
Primulaceae		Rubiaceae	
Androsace septentrionalis	B, C	Galium bifolium	B
#Dodecatheon pulchellum	B, H	Galium boreale	B, C, G, H
#Douglasia montana	B	Galium triflorum	B, C
Ranunculaceae		Salicaceae	
Actaea rubra	B, H	Populus balsamifera	B, C, H
Anemone lithophila	B, C	Populus tremuloides	B, G
Anemone multifida	B	#Salix arctica	C
Aquilegia flavescens	B, H	#Salix arctica X ?	C
Clematis columbiana	B	#Salix bebbiana	B
Clematis hirsutissima	B	#Salix boothii	G
Clematis occidentalis	B	Salix drummondiana	C, G, H
Delphinium bicolor	B, C	#Salix eastwoodiae	C
Delphinium occidentale	B, C, H	Salix exigua	G
Ranunculus eschscholtzii	B, C	#Salix geyeriana	G
Ranunculus uncinatus	B, C, H	Salix lemmonii	B
Thalictrum occidentale	B, C, H	#Salix planifolia	C
		#Salix reticulata	B
		#Salix wolfii var. wolfii	G
		Saxifragaceae	

Heuchera cylindrica	B, C, H
Heuchera parvifolia	B, G
Lithophragma parviflorum	B
Mitella stauropetala	C
Mitella trifida	B, C
Saxifraga bronchialis	B, C, H
#Saxifraga caespitosa	B, C
#Saxifraga integrifolia	B
Saxifraga odontoloma	B, C, H
Saxifraga oregana	C
Saxifraga rhomboidea	C
#Telesonix jamesii	B

Scrophulariaceae

Besseya wyomingensis	B, C
#Castilleja gracillima	G
#Castilleja miniata	B, C, G, H
#Castilleja pulchella	B, C
Castilleja rhexifolia	C
Collinsia parviflora	B, C, G
*Linaria vulgaris	C
Mimulus guttatus	B
Mimulus lewisii	C
#Mimulus suksdorfii	G
Pedicularis bracteosa	B, C
#Pedicularis cystopteridifolia	C
Pedicularis groenlandica	C, G, H
Pedicularis racemosa	B
Penstemon aridus	G
#Penstemon attenuatus	B
Penstemon montanus	B
Penstemon procerus	C, G
#Synthyris pinnatifida	B
Veronica americana	C
Veronica seryllifolia	B, C

Selaginellaceae

Selaginella densa	B, C
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Urticaceae

Urtica dioica	B, C, G, H
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Valerianaceae

Valeriana dioica	B, C
Valeriana edulis	B, G
Valeriana occidentalis	B, C, H

Violaceae

Viola adunca	B
Viola canadensis	B, C
Viola praemorsa	B, C
Viola purpurea	B

APPENDIX C. Element Occurrence Record printouts, and maps showing precise locations and population boundaries.



